

## **Apparatus for Uniaxial Confinement of Rock Cores During Petroleum Formation in Laboratory Pyrolysis**

### ***Background***

Certain sedimentary rocks containing “kerogen” (e.g., oil shale and source rocks) yield petroleum (i.e., oil and gas) when heated. Kerogen is solid, insoluble organic matter dispersed within the rock matrix that decomposes when heated over a period of time to produce oil and gas (collectively “petroleum”). This thermal conversion process is referred to as “pyrolysis.” To simulate petroleum generation within, and expulsion from, thermally immature source rocks or oil shale in a reasonable amount of time, scientists conduct pyrolysis (heating in the absence of oxygen) experiments on petroleum source rocks or oil shales at higher temperatures (300°C and higher) than those commonly encountered under natural subsurface conditions. This invention alleviates the common problems associated with performing pyrolysis by maintaining a uniaxial confinement perpendicular to the petroleum-source rock’s bedding fabric during simulated natural petroleum generation by laboratory pyrolysis, while providing a recoverable intact core for subsequent petrophysical core analyses.

### ***Abstract***

The present invention is a sample core holder for use in uniaxially confining a petroleum-source rock or oil shale core during laboratory pyrolysis experiments that simulate petroleum generation. It has a bottom plate and a plurality of rods having lower ends attached to and equally spaced around the outer edge of the bottom plate. The rods form a space in which to receive a rock core. A top plate is slidably placed on the tops of the rods and lowered so that it is positioned on top of the rock core. The top plate is then secured to the rods while resting on top of the rock core. During the pyrolysis experiments, the top plate and the bottom plate uniaxially confine the rock core to prevent axial

expansion and tensile fractures parallel to a bedding fabric of the rock and to provide a recoverable intact core for subsequent petrophysical analyses.

### ***Opportunity***

Knowing the geochemical and petrophysical properties of a source rock or oil shale as it thermally matures during petroleum formation is important to well log interpretations and rock-core analyses to evaluate their petroleum generation potential and petroleum storage capacity. These evaluations have become especially important in exploring for and developing unconventional shale-gas and shale-oil accumulations. This invention allows for a system and method to evaluate the production of petroleum from a petroleum source rock in a laboratory setting while simulating the effect of overburden pressure on the petroleum-source rock. Allowing for better laboratory results will reduce operational costs and resource allocation during field exploration and development.

### ***Keywords***

- pyrolysis
- petrophysical analyses

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This technology is protected under US patent application 13/443,026. The US Geological Survey is looking for a partner to further the commercialization of this technology through a license agreement or a research agreement. Interested parties should contact:

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